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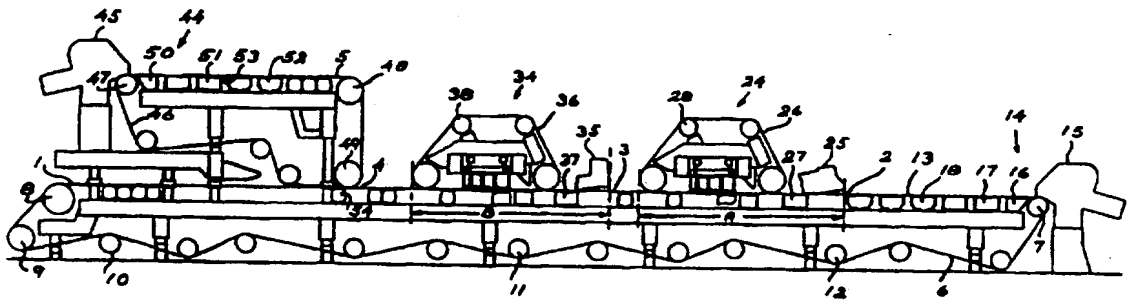

(57) Abstract

In order to meet higher demands for the properties of paperboard products an improved method and machine for the manufacture of paperboard are proposed according to the present invention in which a core (3) of a paperboard web is formed in a second forming unit (24) from a stock with a consistency of 1.5-6.0 % being supplied to the fourdrinier wire (6) of a fourdrinier former carrying a back layer (2) formed previously in a first forming unit (14), from a headbox (25) for high consistency stock and being dewatered upon being enclosed between the fourdrinier wire and a top wire (26) in said second forming unit, and in which an underliner (4) is formed in a third forming unit (34) of stock with a consistency of 0.3-1.4 % being supplied to the fourdrinier wire (6) carrying the back layer and core, from a headbox (35) for stock of low consistency. In both cases dewatering occurs under the influence of upper and lower tables (59, 60; 89, 90) in the loop of respective top wires (26; 36), said tables having slats (69, 74; 99, 104) separated by spaces (68, 75; 98, 105) and defining between them a passage through which a sandwich structure consisting of the fourdrinier wire (6), top wires (26; 36) and stock layer is conveyed and influenced alternatively by upper and lower slats so that the stock layer (3; 4) is compressed alternately from above and below, pressure pulses and shear forces thus being created in the stock layer. Furthermore, in the second forming unit for high consistency forming the stock layer (3) is kept in a fluidized state.

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A method and board machine for manufacturing a paperboard web

The present invention relates to a method of manufacturing a paperboard web in a board machine, the wet end of which comprising a fourdrinier former with a fourdrinier wire running in a loop over a breast roll and suction couch, and a plurality of forming units, a back layer being formed in a first forming unit, a core in a second forming unit, an underliner in a third forming unit and a top layer in a fourth forming unit.

The invention also relates to a board machine for manufacturing a paperboard web, comprising a wet end having a fourdrinier former with a fourdrinier wire running in a loop over a breast roll and suction couch, and a plurality of forming units, including a first forming unit for forming a back layer, a second forming unit for forming a core, a third forming unit for forming an underliner and a fourth forming unit for forming a top layer.

The development is towards increasingly high demands on paperboard products manufactured. This applies both to the demand on mechanical properties and also to the ability of the material to produce a good printing result. New regulations for recovery increase demands for use of recycled fibres to a greater extent. This implies that ever poor fibres shall be used to paperboard products with ever high demands for quality.

A vast number of methods and machines for manufacturing paperboard are described in the literature and have been used in practice with greater or lesser success. The following may be mentioned by way of example: EP-0 511 186 A1, WO 92/06242, US-4,961,824, EP-0 511 185 A1, US-5,074,964, EP-0 233 058 B1 and the

article entitled "Headbox for High-Consistency Forming" in Paper Technology 31, No. 2: 14-18 (February 1990). Common to these methods and machines is that they cannot easily fulfil the requirements mentioned above, particularly in the case of manufacturing folding boxboard which is composed of a top layer, an underliner, a bulky core and a back layer, where it is particularly important for the core to have the best possible properties, such as formation, bulk and grammage profile, and for the underliner to have such uniformity that the top layer formed thereon will have the best possible printability.

The object of the invention is to provide an improved method of manufacturing paperboard and an improved board machine enabling the increasingly high demands placed on paperboard products to be met.

The method according to the present invention is characterized in that the core is formed by stock with a consistency of 1.5-6.0%, preferably 2.5-3.5%, being supplied to the fourdrinier wire carrying the back layer formed previously in the first forming unit, from a headbox for high consistency stock, and is dewatered upon being enclosed between the fourdrinier wire and a top wire of said second forming unit and under the influence of an upper table having slats separated by spaces, in the loop of the top wire, and a lower table having slats separated by spaces, in the loop of the fourdrinier wire, said tables defining between them a passage for a first sandwich structure consisting of the top wire, fourdrinier wire and the layers of stock enclosed therebetween; that on its way through said passage, said first sandwich structure is influenced alternately by the slats of the upper table and the slats of the lower table so that the stock layer supplied from the headbox is compressed alternately from above and below, thereby

being maintained in a fluidized state and pressure pulses and shear forces being created in the stock layer; that the underliner is formed by stock of a consistency of 0.3-1.4%, preferably 0.5-1.0%, being supplied to the fourdrinier wire carrying the previously formed back layer and core, from a headbox for stock of low consistency, and is dewatered upon being enclosed between the fourdrinier wire and a top wire of said third forming unit and under the influence of an upper table having slats separated by spaces, in the loop of the top wire and a lower table having slats separated by spaces, in the loop of the fourdrinier wire, said tables defining between them a passage for a second sandwich structure consisting of the top wire, fourdrinier wire and the layers of stock enclosed therebetween; and that on its way through said passage, said second sandwich structure is influenced alternately by the slats of the upper table and the slats of the lower table so that the stock layer supplied from the headbox is compressed alternately from above and below, thereby creating pressure pulses and shear forces in the stock layer.

The board machine according to the invention is characterized in that said second forming unit comprises a headbox for stock with a consistency of 1.5-6.0%, preferably 2.5-3.5%, a top wire running in a loop having a run cooperating with the fourdrinier wire, and dewatering means comprising an upper table arranged on the lower side of a housing containing suction chambers located in the loop of the top wire, and a lower table arranged on a stand in the loop of the fourdrinier wire, said tables comprising a plurality of slats separated by spaces, the slats of the upper table and the slats of the lower table being arranged opposite each other's spaces, said tables defining between them a passage for a first sandwich structure consisting of the top wire, fourdrinier wire and the two layers of stock enclosed

therebetween; that the third forming unit comprises a headbox for low consistency stock with a consistency of 0.3-1.4%, preferably 0.5-1.0%, a top wire running in a loop and having a run that cooperates with the fourdrinier wire, and dewatering means comprising an upper table arranged on the lower side of a housing containing suction chambers located in the loop of the top wire, and a lower table arranged on a stand in the loop of the fourdrinier wire, said tables comprising a plurality of slats separated by spaces and defining between them a passage for a second sandwich structure consisting of the top wire, fourdrinier wire and the three layers of stock enclosed therebetween.

The forming process for the core provides considerable improvement with regard to formation, surface structure and bulk and enables the use of recycled fibres with high dewatering resistance. The forming process for the underliner provides good forming as well as evening out unevennesses in the middle or core formed thereon since more fibres from the underliner will be collected in areas with little fibre material resulting in pits, whereas less fibres from the underliner will be collected in areas with much material resulting in elevations. This means that the surface of the underliner becomes very uniform, thus creating favourable conditions for the formation of a surface layer with a smooth outer side thereby fulfilling high requirements for printability.

The invention will be described in more detail in the following with reference to the drawings.

Figure 1 shows the wet end of a board machine with fourdrinier former and four different forming units for manufacturing a four-layer paperboard web according to the invention.

Figure 2 shows parts of the second forming unit of the wet end according to Figure 1.

Figure 3 is an enlarged detail of essential dewatering means in the second forming unit according to Figure 2.

Figure 4 shows parts of the third forming unit of the wet end according to Figure 1.

Figure 1 shows schematically a wet end in a board machine for manufacturing a paperboard web 1 composed of four layers - a back layer 2, a core 3, an underliner 4 and a surface or top layer 5. The wet end comprises an extended fourdrinier former having a fourdrinier wire 6 running in a loop around an upstream breast roll 7, a downstream suction couch 8, a wire running roll 9 and a plurality of guide rolls 10 consisting of alignment and tension rolls 11 and 12, respectively, the stock-dewatering and web-forming upper run 13 of the fourdrinier wire 6 between the breast roll 7 and suction couch 8 being flat and horizontal except in certain sections, as will be explained below.

The wet end comprises a plurality of forming units for forming said layers. In the embodiment shown a first forming unit 14 comprises said fourdrinier wire 6 and a headbox 15 arranged near the breast roll 7 to supply a jet of stock on the upper run 13 of the fourdrinier wire 6, said stock having a consistency of 0.2-0.6%. The fourdrinier former has a fourdrinier forming section comprising a forming table 16 and hydrofoils 17. Suction boxes 18 are arranged after the fourdrinier forming section, on the lower side of the flat draw 13 of the fourdrinier wire, in order to dewater the stock, thereby producing a first layer 2, designated back layer, having a consistency of about 6-15%, preferably 8-12%.

The wet end comprises a second forming unit 24 for forming a second layer 3, designated core, in cooperation with the upper run 13 of the fourdrinier wire 6 within a first section A of the fourdrinier former. The second forming unit 24 comprises a headbox 25, a top wire 26 and dewatering means. Downstream of the headbox 25 is a support table 27 for the fourdrinier wire 6. As can be seen in Figure 2, the top wire 26 runs over a plurality of guide rolls 28 and in an accompanying run 29 within said section A for cooperation with the upper run 13 of the fourdrinier wire 6. The headbox 25 of the second forming unit 24 is designed to emit a jet of stock with high consistency within the interval 2.5-3.5%, in order to form the core 3 on the previously formed back layer 2 carried by the fourdrinier wire 6. The dewatering means of the second forming unit 24 dewater the stock so that the two-layer web 2, 3 formed has a consistency of 6-15%, preferably 8-12%.

The wet end also has a third forming unit 34 for forming a third layer 4, designated underliner, in cooperation with the upper run 13 of the fourdrinier wire 6 within a second section B of the fourdrinier former. The third forming unit 34 comprises a headbox 35, a top wire 36 and dewatering means. Downstream of the headbox 35 is a support table 37 for the fourdrinier wire 6. As can be seen in Figure 4, the top wire 36 runs over a plurality of guide rolls 38 and in an accompanying run 39 within said section B for cooperation with the upper run 13 of the fourdrinier wire 6. The headbox 35 of the third forming unit 34 is designed to emit a jet of stock with low consistency within the interval 0.5-1.0%, in order to form the underliner 4 on the previously formed two-layer web 2, 3, carried by the fourdrinier wire 6. The dewatering means in the third forming unit dewater the stock so that the three-layer web 2, 3, 4 formed has a consistency of 6-15%, preferably 8-12%.

Finally, the wet end has a fourth forming unit 44 for forming a fourth layer 5, designated surface layer. This forming may take place in cooperation with the upper run 13 of the fourdrinier wire 6 within a third section of the fourdrinier former and using a forming unit similar to the third forming unit 34. In the alternative embodiment shown the fourth forming unit 44 comprises a short upper fourdrinier wire 46, running in a loop around a breast roll 47, and upper guide roll 48 and a lower guide roll 49, the lower guide roll 49 being arranged close to the upper run 13 of the fourdrinier wire 6 of the fourdrinier former in order to couch together the surface layer 5 formed, with the three-layer web 2, 3, 4. The fourth forming unit 44 comprises a headbox 45 arranged near the breast roll 47 to emit a jet of stock onto the upper flat run 53 of the fourdrinier wire 46, said stock having a consistency of 0.2-0.6%. A forming table 50 and hydrofoils 51 follow the breast roll 47. Suction boxes 52 are arranged downstream of the hydrofoils 51, on the lower side of the flat run 53 of the fourdrinier wire 46, in order to dewater the stock, thereby forming said surface layer 5 with a consistency of 6-15%, preferably 8-12%. A suction box 54 of the extended fourdrinier former causes the four-layer web to adhere to the lower fourdrinier wire 6 so that the web can subsequently be transferred at the suction couch 8 to the press section of the board machine.

The dewatering means in the second forming unit 24 comprise a leading suction box 55 arranged below the fourdrinier wire 6 at the beginning of the run 29 of the top wire 26 along the fourdrinier wire 6, and a separation suction box 56 arranged below and along the fourdrinier wire 6 at the end of the run 29 of the top wire 26 where the top wire 26 leaves the fourdrinier wire 6, so that the two-layer web 2, 3 accompanies the

fourdrinier wire 6 forwards. Said two suction boxes 55, 56 have curved surfaces 57, 58, along which the fourdrinier wire 6 slides, the downstream end of the leading suction box 55 and the upstream end of the separating suction box 56 being arranged below a reference plane at a tangent to the breast roll 7 and suction couch 8. The dewatering means also comprise an upper dewatering table 59 located in the loop of the top wire 26, and a lower dewatering table 60 located in the loop of the fourdrinier wire 6. The tables 59, 60 define a passage between them, through which the fourdrinier wire 6 and top wire 26, enclosing the two-layer web 2, 3 between them, pass in sliding contact with the table 59, 60. The upper table 59 is arranged on the lower side of a housing 61 suspended in a stand 62 via adjustment means 63 enabling the upstream and downstream ends of the table 59 to be raised and lowered independently of each other in order to incline the table 59 in relation to a reference plane at a tangent to the breast roll 7 and suction couch 8, and also enabling the table 59 as a whole to be lowered and set at a level below said reference plane so that the top wire 26 and fourdrinier wire 6 are bent downwards and brought into sliding contact with the curved surfaces 57, 58 of the suction boxes 55, 56. In the embodiment shown the housing 61 comprises four suction chambers 64, 65, 66, 67 to collect the white water pressed up through the top wire 26 due to the suction action. The upper table 59 comprises a plurality of slats 69, fixed in relation to the housing 61 and separated by spaces 68, whereby each suction chamber, except for the first one, is in open communication with its own group of spaces 68 in order to suck up the white water pressed out of the core 3 through the top wire 26. The upstream end of the upper table 59 has a slat 70 which scrapes gently against the top wire 26 in order to deflect the white water that collects on the upper side of the top wire as it passes said leading

suction box 55, to the first suction chamber 64 via an autoslice 71. The upper table 59 has a first or leading straight zone 72 and a second or final curved zone 73 with large radius. The lower table 60 is located opposite the leading straight zone 72 of the upper table 59, and comprises a plurality of slats 74 displaced in relation to the slats 69 of the upper table 59. The slats 74 are separated by spaces 75 in order to deflect the small quantity of white water that is pressed out of the web in downward direction. These spaces 75 are located opposite the slats 69 of the upper table 59, whereas the spaces 68 of the upper table 59 are located opposite the slats 74 of the lower table 60 in an overlapping relationship. The slats 74 of the lower table 60 are mutually adjustable in vertical direction so that their pressure against the fourdrinier wire 6 can be regulated. In the embodiment shown the slats 74 rest on rubber tubes 76 in which the air pressure can be regulated. The slats 74 are carried by a stand 77 via upper and lower U-beams 78, 79 enclosing the rubber tube 76 so that it can press the upper U-beam 78 and its slat 74 in upward direction. The passage between the tables 59 and 60 converges in the direction of travel of the fourdrinier wire 6, the convergence being regulated by the inclination of the upper table 59 by means of adjustment means 63. This convergence, not shown in detail in Figure 3, controls the amount of water remaining in the core in order to retain a fluidized state in the core. The slats with the inclined surfaces 80, 81 contribute to enough water being retained in the stock layer 3 during its forming to prevent the fibres from "freezing".

The slats 69 of the upper table 59 within said leading straight zone 72 and the slats 74 of the lower table 60 have inclined surfaces 80, 81 facing the wires 6, 26 and converging in the direction of travel of the wires 6, 26, so that each slat 69, 74 has a downstream end portion 82

along which the wires 6, 26 slide, and an upstream end portion 83 which is not in contact with the wires 6, 26. The inclined slat surfaces 80, 81 form an angle α of 5-25°, preferably 10-15°, with a reference plane that intersects the downstream end portions 82 of the slat surfaces 80, 81.

The dewatering means in the third forming unit 34 comprise a leading suction box 85 arranged below the fourdrinier wire 6 at the beginning of the run 39 of the top wire 36 along the fourdrinier wire 6, and a separation suction box 86 arranged below and along the fourdrinier wire 6 at the end of the run 39 of the top wire 36 where the top wire 36 leaves the fourdrinier wire 6, so that the three-layer web 2, 3, 4 accompanies the fourdrinier wire 6 forwards. Said two suction boxes 85, 86 have curved surfaces 87, 88, along which the fourdrinier wire 6 slides, the downstream end of the leading suction box 85 and the upstream end of the separating suction box 86 being arranged below a reference plane at a tangent to the breast roll 7 and suction couch 8. The dewatering means also comprise an upper dewatering table 89 located in the loop of the top wire 36, and a lower dewatering table 90 located in the loop of the fourdrinier wire 6. The tables 89, 90 define a passage between them, through which the fourdrinier wire 6 and top wire 36, enclosing the three-layer web 2, 3, 4 between them, pass in sliding contact with the table 89, 90. The upper table 89 is arranged on the lower side of a housing 91 suspended in a stand 92 via adjustment means 93 enabling the upstream and downstream ends of the table 89 to be raised and lowered independently of each other in order to incline the table 89 in relation to a reference plane at a tangent to the breast roll 7 and suction couch 8, and also enabling the table 89 as a whole to be lowered and set at a level below said reference plane so that the top wire 36 and

fourdrinier wire 6 are bent downwards and brought into sliding contact with the curved surfaces 87, 88 of the suction boxes 85, 86. In the embodiment shown the housing 91 comprises four suction chambers 94, 95, 96, 97 to collect the white water pressed up through the top wire 36 due to the suction action. The upper table 89 comprises a plurality of slats 99, fixed in relation to the housing 91 and separated by spaces 98, whereby each suction chamber, except for the first one, is in open communication with its own group of spaces 98 in order to suck up the white water pressed out of the underliner 4 through the top wire 36. The upstream end of the upper table 89 has a slat 100 which scrapes gently against the top wire 36 in order to deflect the white water that collects on the upper side of the top wire as it passes said leading suction box 85, to the first suction chamber 94 via an autoslice (not shown). The upper table 89 has a first or leading straight zone 102 and a second or final curved zone 103 with large radius. The lower table 90 is located opposite the leading straight zone 102 of the upper table 89, and comprises a plurality of slats 104 displaced in relation to the slats 99 of the upper table 89. The slats 104 are separated by spaces 105 in order to deflect the small quantity of white water that is pressed out of the web in downward direction. These spaces 105 are located opposite the slats 99 of the upper table 89, whereas the spaces 98 of the upper table 89 are located opposite the slats 104 of the lower table 90 in an overlapping relationship. The slats 104 of the lower table 90 are mutually adjustable in vertical direction so that their pressure against the fourdrinier wire 6 can be regulated. The slats 104 are influenced by rubber tubes (not shown) in which the air pressure can be regulated. The slats 104 are carried by a stand 107 via elements 108 similar to the beams 78, 79 in Figure 3, said elements enclosing the rubber tubes to press the slats 104 in upward direction. The passage between the tables 89, 90

converges in the direction of travel of the fourdrinier wire 6, the convergence being regulated by the inclination of the upper table 89 by means of adjustment means 93. This convergence controls the amount of water to remain in the underliner.

If desired, an additional forming unit may be used for forming the core, in which case it may have the same design as the second forming unit described above.

C L A I M S

1. A method of manufacturing a paperboard web (1) in a board machine, the wet end of which comprising a fourdrinier former with a fourdrinier wire (6) running in a loop over a breast roll (7) and suction couch (8), and a plurality of forming units, a back layer (2) being formed in a first forming unit (14), a core (3) in a second forming unit (24), an underliner (4) in a third forming unit (34) and a top layer (5) in a fourth forming unit (44), characterized in that the core (3) is formed by stock with a consistency of 1.5-6.0%, preferably 2.5-3.5%, being supplied to the fourdrinier wire (6) carrying the back layer (2) formed previously in the first forming unit (14), from a headbox (25) for high consistency stock, and is dewatered upon being enclosed between the fourdrinier wire (6) and a top wire (26) of said second forming unit (24) and under the influence of an upper table (59) having slats (69) separated by spaces (68), in the loop of the top wire (26), and a lower table (60) having slats (74) separated by spaces (75), in the loop of the fourdrinier wire (6), said tables (59, 60) defining between them a passage for a first sandwich structure consisting of the top wire (26), fourdrinier wire (6) and the layers of stock (2, 3) enclosed therebetween; that on its way through said passage, said first sandwich structure is influenced alternately by the slats of the upper table (59) and the slats (74) of the lower table (60) so that the stock layer (3) supplied from the headbox (25) is compressed alternately from above and below, thereby being maintained in a fluidized state and pressure pulses and shear forces being created in the stock layer; that the underliner (4) is formed by stock of a consistency of 0.3-1.4%, preferably 0.5-1.0%, being supplied to the fourdrinier wire (6) carrying the previously formed back layer and core (2, 3), from a headbox (35) for stock of low consistency, and is

dewatered upon being enclosed between the fourdrinier wire (6) and a top wire (36) of said third forming unit (34) and under the influence of an upper table (89) having slats (99) separated by spaces (98), in the loop of the top wire (36), and a lower table (90) having slats (104) separated by spaces (105), in the loop of the fourdrinier wire (6), said tables (89, 90) defining between them a passage for a second sandwich structure consisting of the top wire (36), fourdrinier wire (6) and the layers of stock (2, 3, 4) enclosed therebetween; and that on its way through said passage, said second sandwich structure is influenced alternately by the slats (99) of the upper table (89) and the slats (104) of the lower table (90) so that the stock layer supplied from the headbox (25) is compressed alternately from above and below, thereby creating pressure pulses and shear forces in the stock layer.

2. A method as claimed in claim 1, characterized in that the fourdrinier wire (6) and the top wire (26) of the second forming unit are brought into contact only with downstream end portions (82) of each slat (69, 74) and are prevented from coming into contact with upstream end portions (83) of each slat (69, 74) by the slats (69, 74) in the upper and lower table (59, 60), respectively, being located opposite the spaces (75, 68) in the lower and upper tables (60, 59), respectively, and the slats having inclined surfaces (80, 81) that converge in the direction of travel of the wires (6, 26), so that said first sandwich structure acquires a wave-shaped movement through said passage.

3. A method as claimed in claim 1 or 2, characterized in that the back layer (2) is formed by stock with a consistency of 0.2-0.6% being supplied to the fourdrinier wire (6) from a headbox (15) for stock with low

consistency and dewatered by the fourdrinier wire (6) running over suction boxes (18).

4. A method as claimed in any of clams 1-3, characterized in that the top layer (5) is formed by stock with a consistency of 0.2-0.6% being supplied to a fourdrinier wire (46) running over a breast roll (47) and a lower guide roll (49) to be brought together with the fourdrinier wire (6) of the fourdrinier former, from a headbox (45) for stock with low consistency and dewatered by the fourdrinier wire (46) running over suction boxes (52), and that the dewatered top layer is couched together with the formed three-layer web (2, 3, 4) to produce the finished four-layer web (1).

5. A method as claimed in any of claims 1-4, characterized in that the stock is dewatered in each forming unit so that the web formed has a consistency of about 6-15%, preferably 8-12%.

6. A board machine for manufacturing a paperboard web (1), comprising a wet end having a fourdrinier former with a fourdrinier wire (6) running in a loop over a breast roll (7) and suction couch (8), and a plurality of forming units, including a first forming unit (14) for forming a back layer (2), a second forming unit (24) for forming a core (3), a third forming unit (34) for forming an underliner (4) and a fourth forming unit (44) for forming a top layer (5), characterized in that said second forming unit (24) comprises a headbox (15) for stock with a consistency of 1.5-6.0%, preferably 2.5-3.5%, a top wire (26) running in a loop having a run (29) cooperating with the fourdrinier wire (6), and dewatering means comprising an upper table (59) arranged on the lower side of a housing (61) containing suction chambers (64-67) located in the loop of the top wire (26), and a lower table (60) arranged on a stand (77) in

the loop of the fourdrinier wire (6), said tables (59, 60) comprising a plurality of slats (69, 74) separated by spaces, the slats (69) of the upper table (59) and the slats (74) of the lower table (60) being arranged opposite each other's spaces (68, 75), said tables (59, 60) defining between them a passage for a first sandwich structure consisting of the top wire (26), fourdrinier wire (6) and the two layers of stock (2, 3) enclosed therebetween; that the third forming unit (34) comprises a headbox (35) for low consistency stock with a consistency of 0.3-1.4%, preferably 0.5-1.0%, at top wire (36) running in a loop and having a run (39) that cooperates with the fourdrinier wire (6), and dewatering means comprising an upper table (89) arranged on the lower side of a housing (91) containing suction chambers (94-97) located in the loop of the top wire (36), and a lower table (90) arranged on a stand (107) in the loop of the fourdrinier wire (6), said tables (89, 90) comprising a plurality of slats (99, 104) separated by spaces (98, 105) and defining between them a passage for a second sandwich structure consisting of the top wire (36), fourdrinier wire (6) and the three layers of stock (2, 3, 4) enclosed therebetween.

7. A board machine as claimed in claim 6, characterized in that the slats (69, 74) of the tables (59, 60) of the second forming unit (24) have inclined surfaces (80, 81) that converge in the direction of travel of the wires (6, 26).

8. A board machine as claimed in claim 7, characterized in that the inclination is 5-25°, preferably 10-15°.

9. A board machine as claimed in any of claims 6-8, characterized in that the first forming unit (14) comprises a headbox (15) for low consistency stock with a consistency of 0.2-0.6%, which is arranged near the

breast roll (7), and dewatering means comprising suction boxes (18) arranged downstream of a fourdrinier forming section of the fourdrinier former.

10. A board machine as claimed in any of claims 6-8, characterized in that the fourth forming unit (44) comprises a fourdrinier wire (46) running in a loop over a breast roll (47) and a lower guide roll (49) to be brought together with the fourdrinier wire (6) of the fourdrinier former for couching together the top layer (5) with the formed three-layer web (2, 3, 4) to form the finished four-layer web, a headbox (45) for low consistency stock with a consistency of 0.2-0.6%, which is arranged near the breast roll (47) pertaining to the fourdrinier wire (46), and dewatering means comprising suction boxes (52) arranged downstream of a fourdrinier forming section of the fourth forming unit (44), a suction box (54) being arranged below the fourdrinier wire (6) of the fourdrinier former, downstream of said lower guide roll (49), in order to ensure that the four-layer web formed does not follow the fourdrinier wire (46) of the fourth forming unit.

11. A board machine as claimed in any of claims 6-9, characterized in that the fourth forming unit (44) coincides, or substantially coincides with said third forming unit (34).

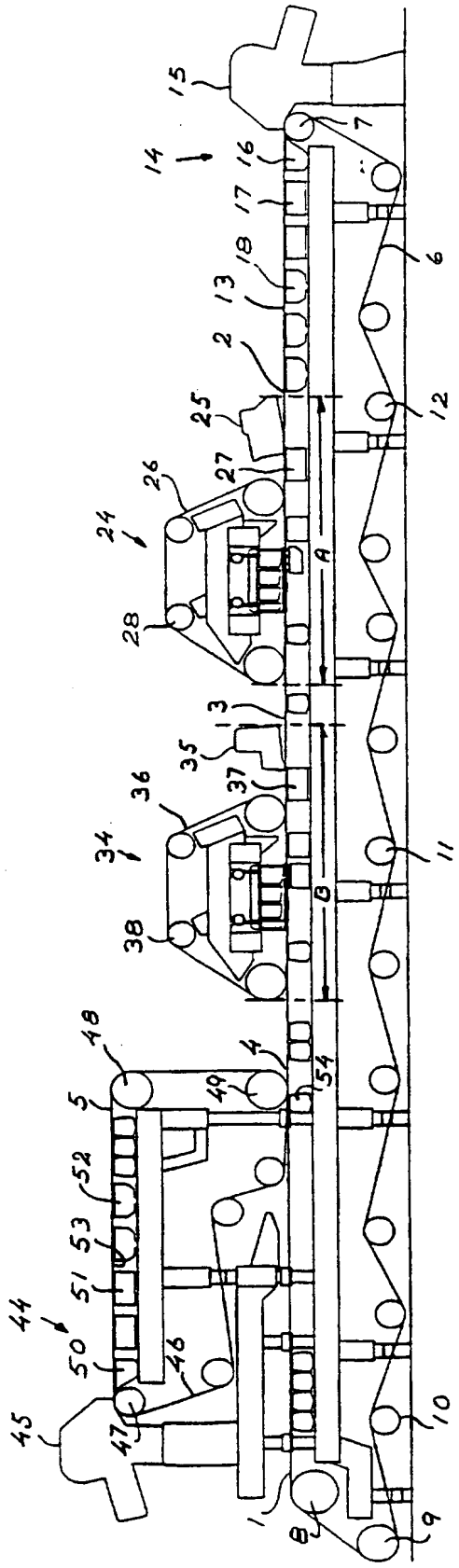
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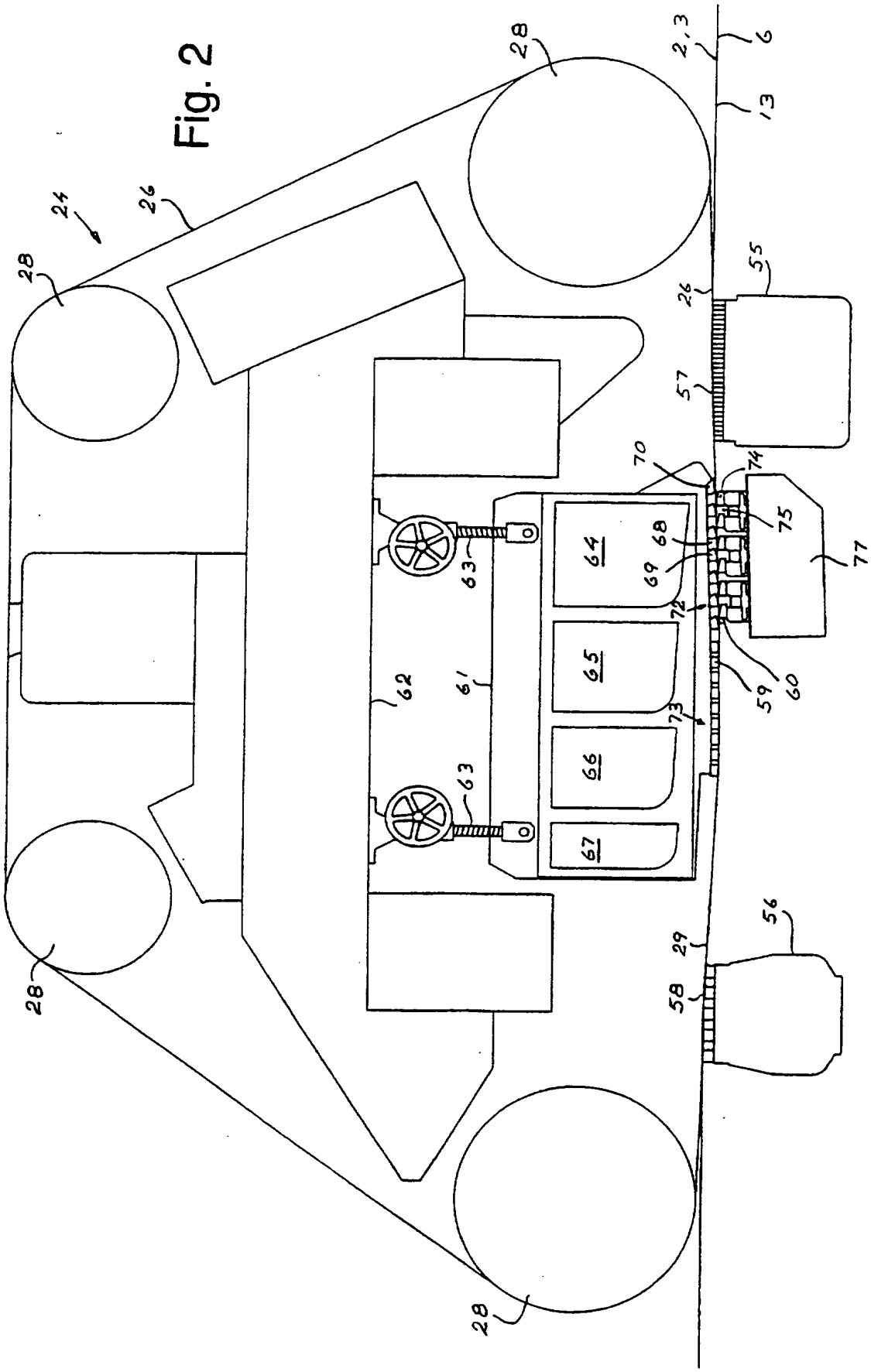
Fig. 1

Fig. 2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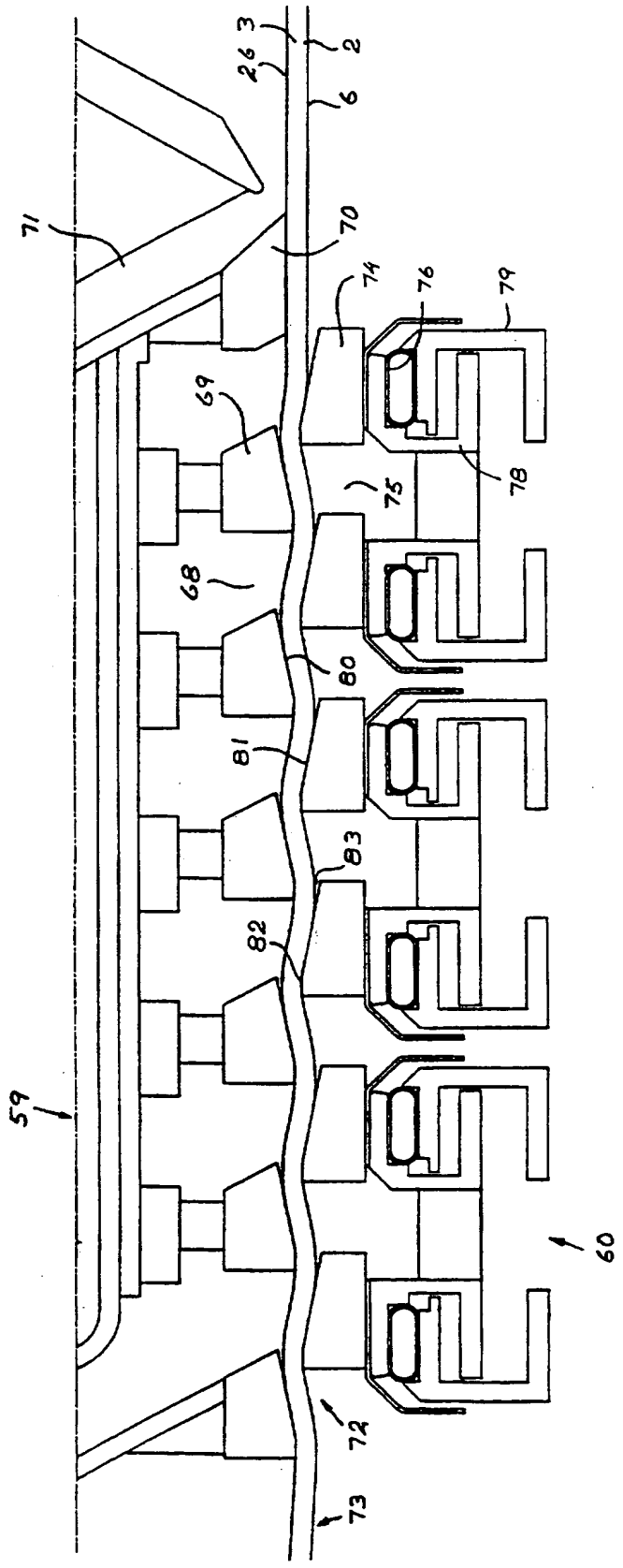
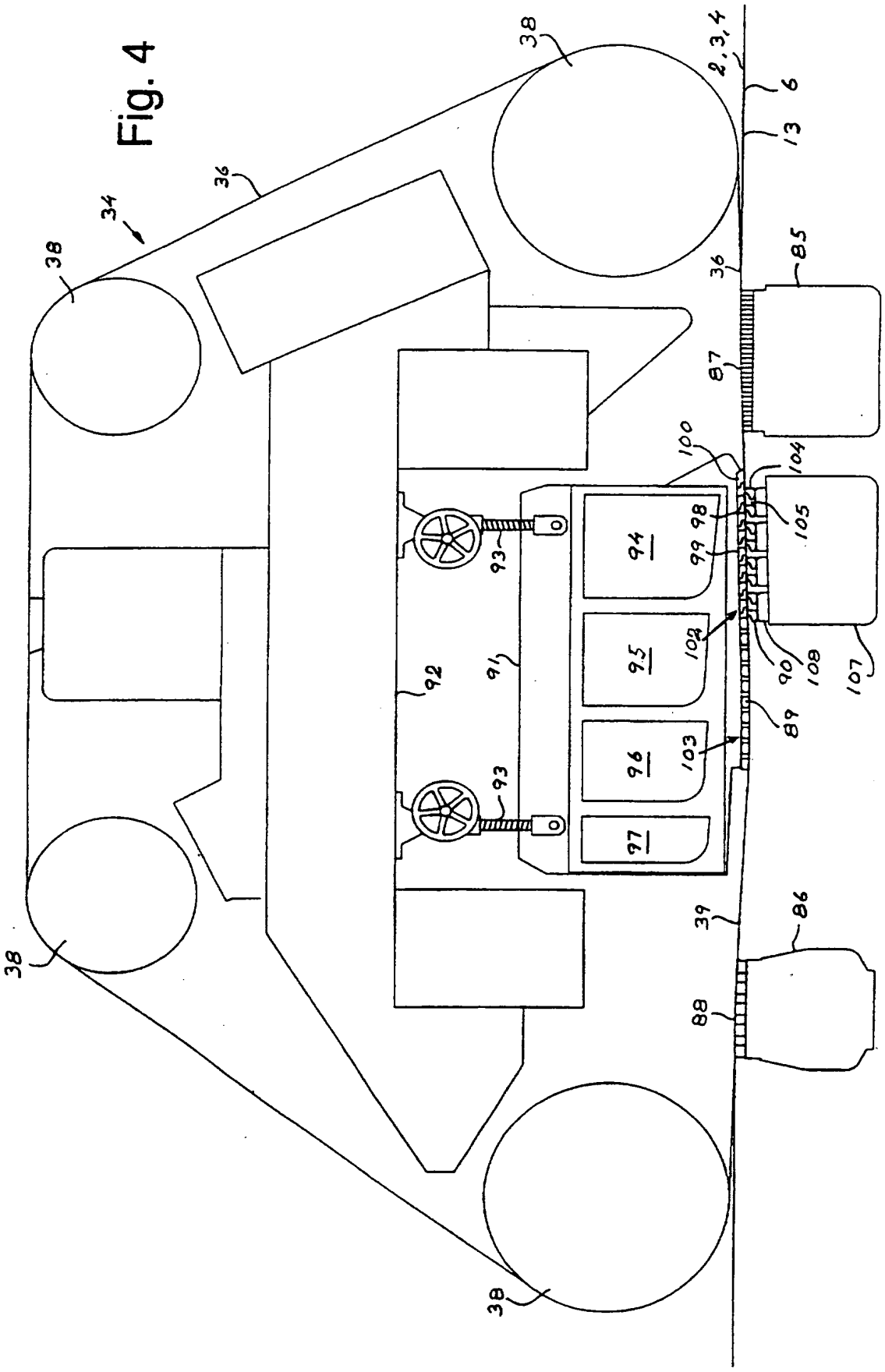


Fig. 3

Fig. 4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INTERNATIONAL SEARCH REPORT

International application No.
PCT/SE 97/00801

A. CLASSIFICATION OF SUBJECT MATTER

IPC6: D21F 11/04
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC6: D21F

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

SE,DK,FI,NO classes as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 5427654 A (P.T. GRAY ET AL), 27 June 1995 (27.06.95) --	1,6
A	US 5074964 A (H. PARTANEN), 24 December 1991 (24.12.91) --	1,6

☐ Further documents are listed in the continuation of Box C. ☒ See patent family annex.

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Date of the actual completion of the international search	Date of mailing of the international search report
8 Sept 1997	12 -09- 1997
Name and mailing address of the ISA/ Swedish Patent Office Box 5055, S-102 42 STOCKHOLM Facsimile No. +46 8 666 02 86	Authorized officer Olov Jensén Telephone No. +46 8 782 25 00

INTERNATIONAL SEARCH REPORT

Information on patent family members

06/08/97

International application No.
PCT/SE 97/00801

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